Ichthyological note

© SFI

Received: 23 Mar. 2018
Accepted: 19 Nov. 2018
Editor: R. Causse

First record of the near threatened native seahorse *Hippocampus reidi* (Teleostei: Syngnathidae) in an ecosystem dominated by the invasive seagrass *Halophila stipulacea* in the Caribbean Sea

by

Mathieu PINAULT* (1, 2), Julien WICKEL (2), Jean-Benoit NICET (2), Marc CHENOZ (3),
Benjamin de MONTGOLFIER (4) & Ronald FRICKE (5)

Résumé. – Premier signalement de l’hippocampe indigène quasi menacé *Hippocampus reidi* (Teleostei : Syngnathidae) dans un herbier dominé par l’espèce exotique envahissante *Halophila stipulacea* dans les Caraïbes.

Un spécimen d’hippocampe à long nez (*Hippocampus reidi*) a été photographié dans un herbier dominé par l’espèce invasive *Halophila stipulacea* à 11 m de profondeur, le 9 juin 2017, devant la plage de Madiana, Schœlcher, Martinique, mer des Caraïbes. Cette courte communication rapporte la première observation de *H. reidi* dans cet écosystème exotique.

Key words. – Alien ecosystem – Anthropogenic impacts – Conservation policy – Near Threatened species – Martinique Island – Replacement habitat.

Seagrasses are recognized as preferred habitats for many seahorse species, whether they are European (Curtis and Vincent, 2005), Indo-Pacific (Unsworth and Cullen, 2010) or Caribbean species (Dias and Rosa, 2003). According to Teske and Beheregaray (2009), the morphological evolution of seahorses is even related to the expansion of seagrass beds during the Oligocene. Regression of these habitats could then threaten the persistence of the most dependent species (Hughes *et al*., 2009).

The longsnout seahorse *Hippocampus reidi* Ginsburg, 1933 was originally described from Grenada, West Indies by Ginsburg (1933), but later found to be widespread in the western Atlantic from North Carolina (USA) to southern Brazil, though uncommon throughout its range (Lieske and Myers, 1994; Floeter *et al*., 2003; Hercos and Giarrizzo, 2007; Kuiter, 2009). This seahorse species (Fig. 1) is currently classified as Near Threatened (NT) (Oliveira and Pollom, 2017). The international trade of this species for aquarium and ornamentation is regulated by a licensing system (CITES II, since 15 May 2004). A specimen of *H. reidi* was photographed on the west coast of the Martinique Island, within an exotic ecosystem developed around the alien seagrass *Halophila stipulacea* (Forsskål, 1775).

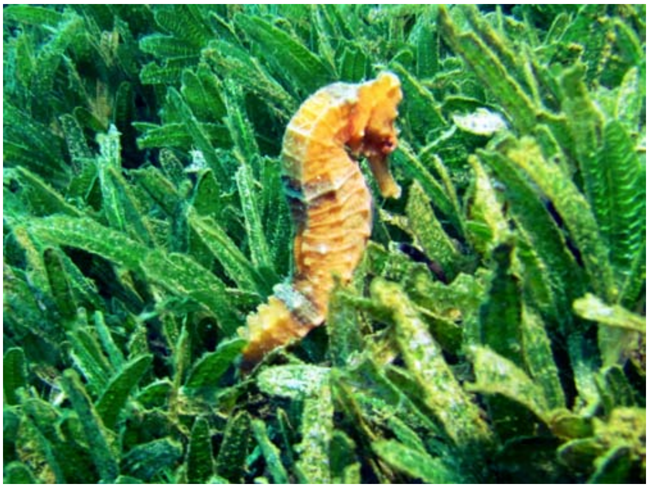

Figure 1. – Specimen of *Hippocampus reidi* Ginsburg, 1933, photographed in a dense *Halophila stipulacea* seagrass bed on the west coast of Martinique Island, on 9th June 2017.

The seagrass species was originally described from Yemen, southern Red Sea (Forsskål, 1775, as *Zostera stipulacea*). Besides the Red Sea, *H. stipulacea* is also distributed in the western Indian Ocean from East Africa, the Arabian Sea and the Persian Gulf to Madagascar and India (den Hartog, 1970). After colonizing the Mediterranean Sea via the Suez Canal in the 1970s as a Lessepsian migrant (den Hartog, 1972; Lipkin, 1975a, b), the species has spread to the Caribbean region since the early 2000s, where it has been described for the first time in 2002 (Ruiz and Ballantine, 2004). It has since been recorded on the west side of Martinique in 2006 (Maréchal *et al*., 2013; Willette *et al*., 2014), where it quickly became dominant in most of the seagrass beds on the northwest coast (Legrand, 2010).

Given the recent introduction of *H. stipulacea* in the Caribbean, very little work has been published to date on the ecosystem associated with this species and the more specifically concerned benthic macroinvertebrates, which can be subjected to local conservation issues, particularly related to their fishing interest and for ornamentation (Scheibling *et al*., 2018). Some recent works have described new records from Martinique, found in *H. stipulacea* seagrasses, but these dealt with introduced species such as the swimming crab *Charybdis hellerii* (Milne-Edwards, 1867) (Ferry *et al*., 2017). Two other recent works (Willette and Ambrose, 2012; Olinger *et al*.,

---

(1) UMR 9220 UR CNRS IRD ENTROPIE, 15 avenue René Cassin, BP 7151, 97715 Saint-Denis, Reunion. [math.pinault@gmail.com]
(2) MAREX, 697 chemin de la Surprise, 97436 Saint-Leu, Réunion. [julien.wickel@gmail.com], [jbenoit.nicet@gmail.com]
(3) Setec in vivo, 4 place Sadi Carnot, 13002 Marseille, France. [marc.chenoz@invivo.setec.fr]
(4) Aquasearch, ZAC Les Coteaux, 97228 Sainte-Luce, Martinique. [b.montgolfier@aquasearch.fr]
(5) ImRamstal 76, 97922 Lauda-Königshofen, Germany. [ronfricke@web.de]
* Corresponding author

Cybium 2018, 42(4): 393-396. doi: 10.26028/cybium/2018-424-015

2017) have shown that fish populations in *H. stipulacea* seagrasses showed some significant differences from fish populations in native seagrasses, such as two times less juveniles and larger fish, with a much higher abundance of epibiotic invertebrates in *H. stipulacea* seagrasses.

The aim of this brief communication is to illustrate that, despite its invasive exotic character, this new ecosystem seems to offer refuge to a native seahorse species, whose original habitat, dominated by *Thalassia testudinum* König, 1805 and *Syringodium filiforme* Kützing *in* Hohenacker, 1860, have faced in Martinique a reduction over decades, well before the introduction of *H. stipulacea*, especially near the bay of Fort-de-France, under the influence of anthropogenic pressure (Bouchon-Navaro *et al.*, 1992, 2004). In this context, the longsnout seahorse may be regarded as a flagship species, helping to promote the necessary restocking and restoration of native seagrasses in parallel with any management policy for the eradication of *H. stipulacea* in the Caribbean.

MATERIAL AND METHODS

Sampling was conducted along a 750 m transect, located perpendicular to the Schœlcher coast, north of Fort-de-France Bay, on 9th June 2017, between 2 m and 60 m depth. The deepest part of the transect (45 m to 60 m) was explored by a GoPro®-type underwater video device (Hero5® black model), directed from a boat. The littoral section (2 m to 45 m) was explored in scuba diving, simultaneously by four divers, spaced about 10 m apart, moving parallel to each other on both sides of the transect (Fig. 2). The total area sampled in scuba diving was estimated at 2.85 ha.

The specimen of *H. reidi* described in this study was photographed in front of Madiana beach at 1020 hrs, 14°36.618'N; 61°6.087'W, at 11 m depth. The location of the site was provided by a Garmin® GPS (eTrex® 20 model, Garmin LTD, Schaffhausen, Switzerland) from the surface and the photograph was taken by a Sony® digital camera (DSC® RX100-II model) equipped with its waterproof case.

The identification of *H. reidi* was made on the basis of the morphological characters observed *in situ* and on photography. The visual overestimate of the fish height, due to the modification of the vision in scuba diving (increasing object length), was adjusted according to Edgar *et al.* (2004). Body measurements and the number of rays on the dorsal fin were recorded *ex post*, on photographic basis. Specialized literature on Caribbean fish (Lieske and Myers, 1994; Floeter *et al.*, 2003) and on seahorses specifically (Lourie *et al.*, 1999, 2004, 2016; Kuiter, 2009) have provided the necessary identification keys for the recognition of the species and the sex of the specimen.

RESULTS

The female photographed specimen had a very long and thick snout and tiny brown spots, barely visible, distributed mainly around the eye and at the edges of four large clear transverse bands distributed along its body. Body colour was mostly yellow to light brown. It had a total number of 16 dorsal-fin rays. Its total length was 17 cm, its height was 13 cm and its trunk was 3 cm width.

The photographed specimen was observed for 5 min in its environment. Very little mobile, it remained attached to a leaf of the seagrass by its tail during all the time of observation. The individual was solitary, no congener was observed around.

DISCUSSION

The main distinctive morphological characters of the species *H. reidi* are a long and thick snout and the presence of 16 to 19 rays on the dorsal fin. The body colours are variable: from yellow to brown, but it always presents tiny black dots scattered on the whole body (Lourie *et al.*, 2016). In addition, the great height (maximum observed height of the species: 20 cm in Brazil; Rosa *et al.*, 2007), the near disappearance of fine brown spots on the flanks, the large width of its trunk and the absence of brood pouch for egg incubation has confirmed its identification as a female individual (Rosa *et al.*, 2002; Oliveira *et al.*, 2010).

Two closely related species occur in the Western Atlantic: *Hippocampus zosterae* Jordan & Gilbert, 1882, which has 10 to 13 dorsal rays and is easily distinguished by its short snout and its small

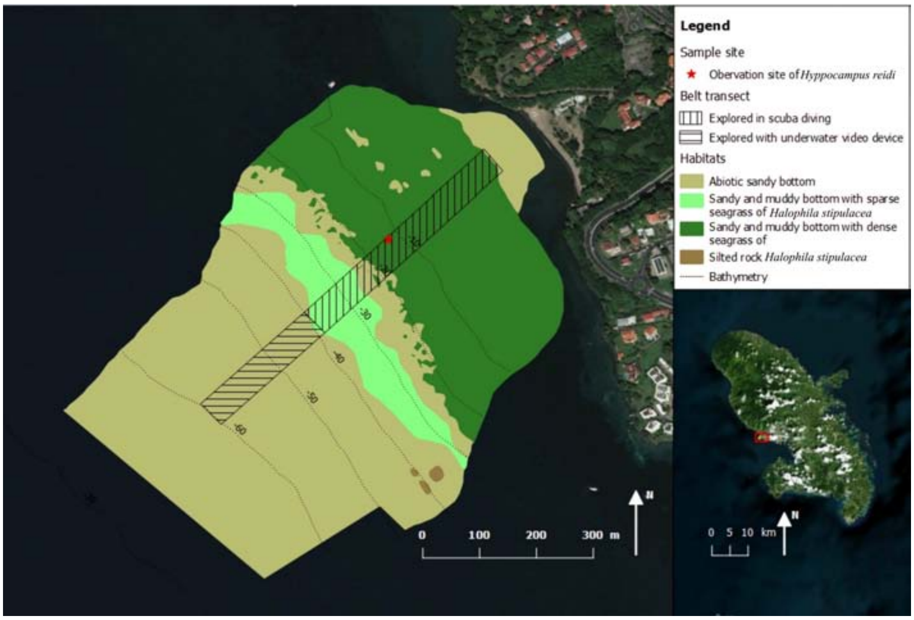
Legend
Sample site
★ Obervation site of *Hyppocampus reidi*
Belt transect
Explored in scuba diving
Explored with underwater video device
Habitats
Abiotic sandy bottom
Sandy and muddy bottom with sparse seagrass of *Halophila stipulacea*
Sandy and muddy bottom with dense seagrass of
Silted rock *Halophila stipulacea*
Bathymetry
-30
-40
-50
-60
0 100 200 300 m
N
0 5 10 km
N

Figure 2. – Map of the study area with observation site; Madiana beach, Schœlcher, West coast of Martinique Island. June 2017.

size of less than 3 cm body height. *Hippocampus erectus* Perry, 1810, which has 18 to 21 dorsal rays and has pigmented fine dark lines on its head and body (Lourie *et al*., 1999, 2004, 2016).

H. reidi has been referenced in Martinique since the 1990s by the work of Bouchon-Navaro *et al*. (1992) and Louis *et al*. (1992) carried out on seagrasses and mangroves of the Fort-de-France Bay. It also appears in a synthetic work carried out by the same authors in 2004 on the French Antilles seagrasses (Bouchon-Navaro *et al*., 2004). It therefore seems rather closely linked to the native seagrasses, located near the Fort-de-France Bay, which tends to support the idea of a replacement of its original habitat by seagrasses of *H. stipulacea* that were recently introduced.

To date, very little work has been done to characterize fish communities found in *H. stipulacea* seagrasses in the Caribbean and to compare them with those found in their native habitats, namely *T. testudinum* and *S. filiforme*. Only works by Willette and Ambrose (2012) and Olinger *et al*. (2017) bring some elements related to the subject, but these works focused mainly on comparing the recruitment capacities of native and exotic seagrasses in juvenile-stage fish and did not address seagrass beds as potential replacement habitats for species originally associated with native ecosystems, which have undergone a drastic reduction of their surface due to human activity before the introduction of *H. stipulacea* in the Caribbean (Bouchon-Navaro *et al*., 1992, 2004). However, it is recognized that *H. reidi* is relatively adaptable in terms of habitat (Dias and Rosa, 2003; Rosa *et al*., 2007). It sometimes uses various forms of supports to cling to the substrate (green algae, marine phanerogams, ascidians, mangrove roots). It is therefore not surprising that in this study, a substitution of its natural habitat of *T. testudinum* and *S. filiforme* with the exotic habitat of *H. stipulacea* was observed.

This study provides a first description, with a focus on an emblematic species, described as a potential flagship species by Rosa *et al*. (2002), of the ecological potential of this new ecosystem in full bloom, in a context of a gradual reduction of the most comparable native ecosystems that are seagrass beds of *T. testudinum* and *S. filiforme*. This study is also one of the rare descriptions of *H. reidi* in its natural environment. Authors as Rosa *et al*. (2002), Diaz and Rosa (2003) and Olivotto *et al*. (2008) proposed, as conservation recommendation, to study its population parameters and ecology in the wild.

However, the broader scope of this study suggests that there is a possible conflict of management strategies between eradication of invasive seagrasses and conservation of threatened species. This study supports the view that any measure of management or eradication of the exotic species *H. stipulacea* in the Caribbean should be considered taking into account its potential for substitution of native seagrasses of *T. testudinum* and *S. filiforme* as habitat. Thus, removal of alien seagrasses should not take place without restocking and restoration of native seagrasses.

Acknowledgements. – We thank anonymous referees for their help in improving the manuscript.

REFERENCES

BOUCHON-NAVARO Y., BOUCHON C. & LOUIS M., 1992. – L'ichtyofaune des herbiers de phanérogames marines de la baie de Fort-de-France (Martinique, Antilles françaises). *Cybium*, 16: 307-330.

BOUCHON-NAVARO Y., BOUCHON C. & LOUIS M., 2004. – L'ichtyofaune des herbiers de Phanérogames marines des Antilles françaises: intérêt de leur protection. *Rev. Ecol. (Terre Vie)*, 59: 253-272.

CURTIS J.M. & VINCENT A.C., 2005. – Distribution of sympatric seahorse species along a gradient of habitat complexity in a seagrass-dominated community. *Mar. Ecol. Prog. Ser.*, 291: 81-91.

DEN HARTOG C., 1970. – The Seagrasses of the World. 275 p. Amsterdam, London: North-Holland publishing company.

DEN HARTOG C., 1972. – Range extension of *Halophila stipulacea* (Hydrocharitaceae) in the Mediterranean. *Blumea*, 20: 154.

DIAS T.L. & ROSA I.L., 2003. – Habitat preferences of a seahorse species, *Hippocampus reidi* (Teleostei: Syngnathidae). *Braz. Aquat*., 6: 165-176.

EDGAR G.J., BARRETT N.S. & MORTON A.J., 2004. – Biases associated with the use of underwater visual census techniques to quantify the density and size-structure of fish populations. *J. Exp. Mar. Biol. Ecol*., 308: 269-290. doi: 10.1016/j.jembe.2004.03.004.

FERRY R., BUSKE Y., POUPIN J. & SMITH-RAVIN J., 2017. – First record of the invasive swimming crab *Charybdis hellerii* (A. Milne Edwards, 1867) (Crustacea, Portunidae) off Martinique, French Lesser Antilles. *Bioinvasions Rec*., 6: 239-247.

FLOETER S.R., GASPARINI J.L., ROCHA L., FERREIRA C.E.L., RANGEL C.A. & FEITOZA B.M., 2003. – Brazilian reef fish fauna: checklist and remarks (updated Jan. 2003). Brazilian Reef Fish Project. http://www.brazilianreeffish.cjb.net.

FORSSKÅL P., 1775. – Flora Ægyptiaco-Arabica sive descriptiones plantarum quas per Ægyptum inferiorem et Arabiam felicem detexit, illustravit Petrus Forskål, Prof. Haun. Post mortem auctoris editit Carsten Niebuhr. 379 p. Copenhagen: Möller Hauniae.

GINSBURG I., 1933. – Descriptions of five new species of seahorses. *J. Wash. Acad. Sci*., 23: 560-563.

HERCOS A.P. & GIARRIZZO T., 2007. – Pisces, Syngnathidae, *Hippocampus reidi*: filling distribution gaps. *Check List*, 3: 287-290.

HUGHES A.R., WILLIAMS S.L., DUARTE C.M., HECK K.L. & WAYCOTT M., 2009. – Associations of concern: declining seagrasses and threatened dependent species. *Front. Ecol. Environ*., 7: 242-246.

KUITER R.H., 2009. – Seahorses and Their Relatives. 334 p. Seaford: Aquatic Photographics.

LEGRAND H., 2010. – Mapping marine benthic communities and reef degradation in Martinique in relation to anthropogenic sources of pressure. Ph.D. thesis. 297 p. École Pratique des Hautes Études.

LIESKE E. & MYERS R., 1994. – Collins Pocket Guide. Coral Reef Fishes. Indo-Pacific & Caribbean including the Red Sea. 400 p. New York: Harper Collins Publishers.

LIPKIN Y., 1975a. – *Halophila stipulacea*. A review of a successful immigration. *Aquat. Bot*., 1: 203-215.

LIPKIN Y., 1975b. – *Halophila stipulacea* in Cyprus and Rhodes, 1967-1970. *Aquat. Bot*., 1: 309-320.

LOUIS M., BOUCHON C. & BOUCHON-NAVARO Y., 1992. – L'ichtyofaune de mangrove dans la baie de Fort-de-France (Martinique). *Cybium*, 16: 291-305.

LOURIE S.A., VINCENT A.C.J. & HALL H.J., 1999. – Seahorses: an Identification Guide to the World's Species and Their Conservation. 214 p. London: Project Seahorse.

LOURIE S.A., FOSTER S.J., COOPER E.W.T. & VINCENT A.C.J., 2004. – A Guide to the Identification of Seahorses. 120 p. Vancouver: University of British Columbia and WWF.

LOURIE S.A., POLLOM R.A. & FOSTER S.J., 2016. – A global revision of the seahorses *Hippocampus* Rafinesque 1810 (Actinopterygii: Syngnathiformes): taxonomy and biogeography with recommendations for further research. *Zootaxa*, 4146: 1-66.

MARÉCHAL J.P., MEESTERS E.H., VEDIE F. & HELLIO C., 2013. – Occurrence of the alien seagrass *Halophila stipulacea* in Martinique (French West Indies). *Mar. Biodivers. Rec.* 6: 1-5.

OLINGER L.K., HEIDMANN S.L., DURDALL A.N., HOWE C., RAMSEYER T., THOMAS S.G., LASSEIGNE D.N., BROWN E.J., CASSELL J.S., DONIHE M.M., ROMERO M.D.D., DUKE M.A. GREEN D., HILLBRAND P., GRIMES K.R.W., NEMETH R.S., SMITH T.B. & BRANDT M., 2017. – Altered juvenile fish communities associated with invasive *Halophila stipulacea* seagrass habitats in the US Virgin Islands. *PLoS ONE*, 12: e0188386.

OLIVEIRA T.P.R. & POLLOM R., 2017. – *Hippocampus reidi*. The IUCN Red List of Threatened Species 2017: e.T10082A17025021. http://www.iucnredlist.org/details/10082/0

OLIVEIRA T.P.R., CASTRO A.L.C. & ROSA I.L., 2010. – Novel sex-related characteristics of the longsnout seahorse *Hippocampus reidi* Ginsburg, 1933. *Neotrop. Ichthyol.*, 8: 373-378

OLIVOTTO I., AVELLA M.A., SAMPAOLESI G., PICCINETTI C.C., RUIZ P.N. & CARNEVALI O., 2008. – Breeding and rearing the longsnout seahorse *Hippocampus reidi*: rearing and feeding studies. *Aquaculture*, 283: 92-96.

ROSA I.L., DIAS T.L. & BAUM J.K., 2002. – Threatened fishes of the world: *Hippocampus reidi* Ginsburg, 1933 (Syngnathidae). *Environ. Biol. Fish.*, 64: 378

ROSA I.L., OLIVEIRA T.P.R., CASTRO A.L.C., SOUZA MORAES L.E., XAVIER J.H.A., NOTTINGHAM M.C., DIAS T.L.P., BRUTO-COSTA L.V., ARAÚJO M.E., BIROLO A.B., MAI A.C.G. & MONTEIRO-NETO C., 2007. – Population characteristics, space use and habitat associations of the seahorse *Hippocampus reidi* (Teleostei: Syngnathidae). *Neotrop. Ichthyol.*, 5: 405-414.

RUIZ H. & BALLANTINE D.L., 2004. – Occurrence of the seagrass *Halophila stipulacea* in the tropical West Atlantic. *Bull. Mar. Sci.*, 75: 131-135.

SCHEIBLING R.E., PATRIQUIN D.G. & FILBEE-DEXTER K., 2018. – Distribution and abundance of the invasive seagrass *Halophila stipulacea* and associated benthic macrofauna in Carriacou, Grenadines, Eastern Caribbean. *Aquat. Bot.*, 144: 1-8.

TESKE P.R. & BEHEREGARAY L.B., 2009. – Evolution of seahorses' upright posture was linked to Oligocene expansion of seagrass habitats. *Biol. Lett.* doi: 10.1098/rsbl.2009.0152.

UNSWORTH R.K. & CULLEN L.C., 2010. – Recognising the necessity for Indo-Pacific seagrass conservation. *Conserv. Lett.*, 3: 63-73.

WILLETTE D.A. & AMBROSE R.F., 2012. – Effects of the invasive seagrass *Halophila stipulacea* on the native seagrass, *Syringodium filiforme*, and associated fish and epibiota communities in the Eastern Caribbean. *Aquat. Bot.*, 103: 74-82.

WILLETTE D.A., CHALIFOUR J., DEBROT A.D., ENGEL M.S., MILLER J., OXENFORD H.A., SHORT F.T., STEINER S.C.C. & VÉDIE F., 2014. – Continued expansion of the trans-Atlantic invasive marine angiosperm *Halophila stipulacea* in the Eastern Caribbean. *Aquat. Bot.*, 112: 98-102.